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S-5! suggestions for spacing of S-5 clamps for PV assemblies

The following suggestions assume that determination has been made that the roof to which the S-5! clamps will be attached is structurally adequate. Any loads imposed on the S-5! clamps will be transferred to the panels. Panel seams must have sufficient flexural strength to carry these loads. Panels must also be adequately attached to the building structure, and the structure must be sufficient to carry these loads. The makers of S-5! clamps make no representations with respect to these variables. It is the responsibility of the user to verify this information, or seek assistance from a qualified design professional, if necessary.

The key to frequency and spacing of attachment points for PV is to distribute loads to the metal standing seam panels in a manner that is consistent with the intended distribution of loads from the roof panels into the building structure. With very few exceptions, the attachment of a single S-5 clamp (even the "mini") to the seam will be stronger than a single point of attachment of the seam to the building structure. Hence the "weak link" is not the S-5 clamp, but the attachment clips that hold the metal panels to the building structure, or the beam strength of the roof panel seam, itself.

The most conservative approach to the spacing/frequency of PV attachment to the roof is to determine the spacing/frequency of the roof's attachment to the building structure, then duplicate it at minimum. Determining panel attachment spacing in one axis is very simple. Standing seam panels' attachment will be made using concealed hold-down clips within the seam area of the panel. So, in that axis, the clip spacing is the same as the seam spacing. The location of the clips along the seam (in the other axis) can be determined by a) consultation with the roof system manufacturer or installer, b) checking from the underside or, c) close examination from the topside along the seam. There will usually be a slight, but detectable, deformation of the seam at the clip location visible from the roof's topside. Many standing seam roofing systems are installed on "pre-engineered steel" buildings. The attachment spacing in that industry is typically 5'-0" and is readily apparent by inspecting the structural purlins to which the panel clips are attached from the roofside (interior of the building).

If the panel clips are spaced, for instance, 5'-0" on center along the seam, then use the 5'-0" dimension as a maximum spacing for the S-5 clamps. (S-5 clamps may also be spaced at closer centers, but not wider.) When modules are direct attached (without racking) in the landscape orientation, this spacing dimension is dictated by the smallest dimension of the PV frame. Using the roof panel clip spacing as a maximum spacing template for S-5 clamps is a sound practice, whether the PV modules are attached direct to S-5, or to a racking system, which is in turn attached to the S-5 (and panel seams). To evenly distribute loads, it is also necessary that each seam be involved in the finished assembly. Thus, every time a seam is traversed, it should be attached. Such an attachment scheme should evenly distribute wind loads into the building structure through the panels and their attachment, as was intended in the original roof construction assembly.

Please note these are only suggestions. Wind dynamics are complex, and S-5! advises review by a qualified licensed professional who understands wind effects and metal roof design and construction.

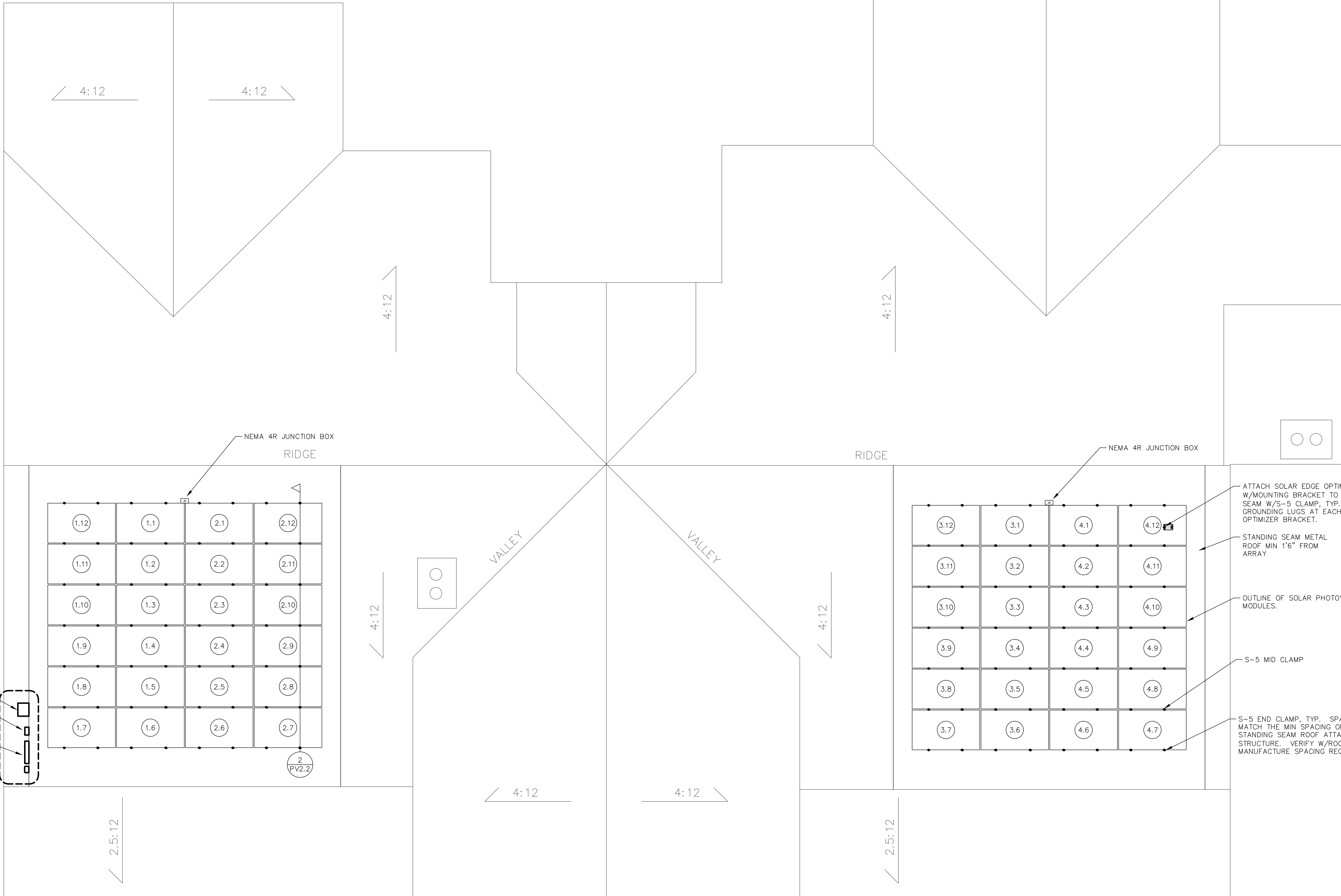
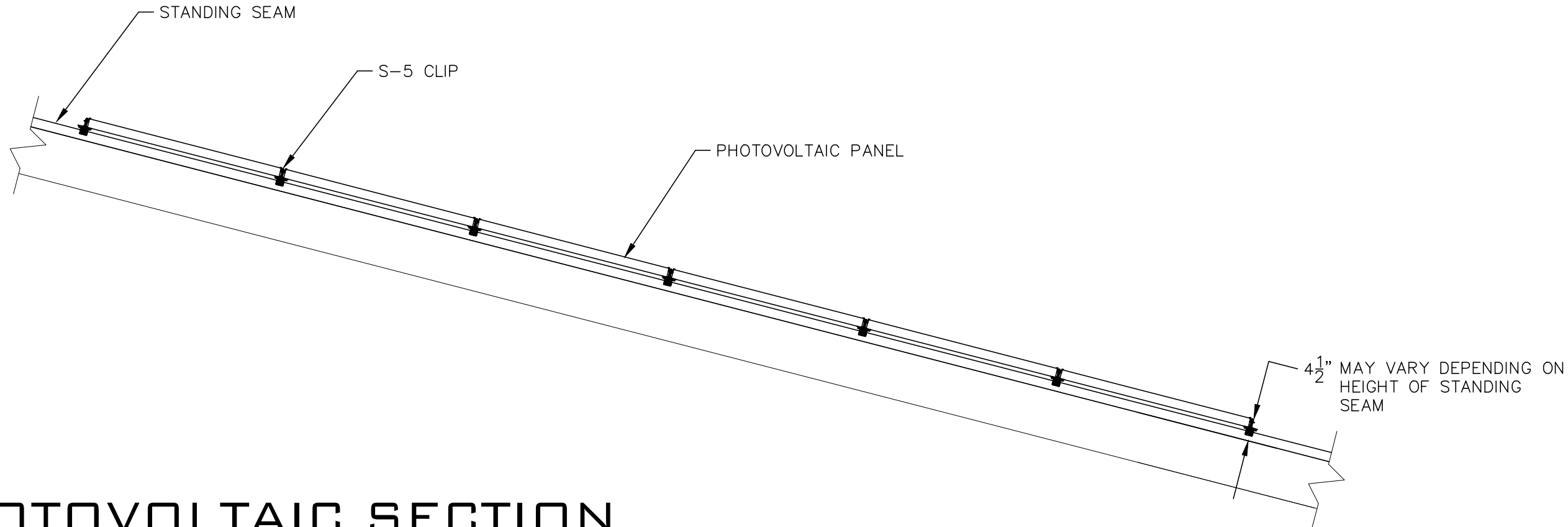
NOTES:

1. CONFIGURATION SHOWN IS CONCEPTUAL. REFER TO ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR EXACT CONFIGURATION

2

SOLAR PHOTOVOLTAIC SECTION

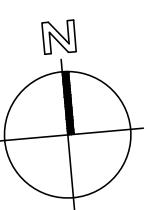
SCALE: NONE



1

SOLAR PHOTOVOLTAIC RACKING SYSTEM LAYOUT

SCALE: 1/4" = 1'-0"



PV GENERAL NOTES

SOLAR PHOTOVOLTAIC GENERAL NOTES

SYSTEM DESCRIPTION:

The complete PV system described herein shall be installed and Commissioned such that it operates automatically as follows:

1. When grid power is present, solar power runs loads on site during the day and excess power spins the meters backwards and credits the account as per the requirements of the California Net Metering Law.
2. When grid power fails, the PV system shuts down and will not provide power to any loads.
3. The PV system automatically resumes generation once grid power of the proper voltage and frequency (as mandated by IEEE standards) is restored and there is sufficient sunlight.

Installation Notes:

1. It is the installer's responsibility to assure the system functions properly, safely, and meets all local, state and regional codes.
2. Installer to supply and install all materials shown on this plan and all others needed to complete this Solar Photovoltaic (PV) system. Also, provide any incidental work not shown or specified, which can be reasonably inferred as belonging to the work necessary to provide the complete system.
3. This plan does not constitute a complete installation guide for a solar photovoltaic system. The installer shall be factory trained, properly licensed and reasonably experienced in the installation of solar PV systems. CEC, CSI Guidelines and installation procedures shall be followed in effecting the installation.
4. Installer shall follow article 29 CFR Part 1926 subparts safety guidelines.
5. Coordinate with Architect, General Contractor and the work of all other trades.
6. Work shall comply with requirements of building inspectors and all local, state and federal codes, including 2008 NEC Article 690 for PV Systems, CEC, CBC, CMC, CPC, CFC, UL, and OSHA. Installation of equipment and materials shall comply with manufacturer's installation instructions, industry standards and local fire district Regulations.
7. The photovoltaic system shall be built by a licensed (C-45) Solar Contractor or a licensed (C-10) electrical contractor or a licensed general contractor with either a C-10 or a C-46 working as a sub-contractor to the general contractor.
8. PV system shall be guaranteed for a period of ten years from the date of acceptance by the Owner.
9. All equipment shall be listed and labeled per recognized electrical testing laboratory and installed per the listing requirements and the manufacturer's instructions.
10. All inverters shall be IEEE 929 compliant and shall be inspected by PG&E before commissioning, testing, and operation of the system.
11. All outdoor equipment shall be NEMA 3R, including roof mounted transition boxes and switches.
12. All equipment shall be properly grounded per the requirements of NEC ART. 250.
13. NEC ART. 690.9(a). All circuits connected to more than one source shall have overcurrent devices LOCATED SO AS TO PROVIDE OVERCURRENT PROTECTION FROM ALL SOURCES.
14. NEC ART. 690.18. Due to the fact that PV modules are energized whenever they are exposed to light, PV contractor shall disable the array during installation and service by short circuiting, open circuiting, or covering the array with an opaque covering.
15. Photovoltaic system shall be backedfed the distribution system on site per the requirements of NEC ART. 690.64(b). All backedfed breakers shall be identified as such and shall be secured in place by an additional fastener per the requirements of NEC 408.16(f) (408.36(f) in 2005 nec).
16. Any substituted material, substituted equipment, or installation changes must be submitted to the engineer (MEG) or Architect and owner for evaluation and approval prior to installation or implementation on the job.
17. Any substituted equipment installed without the approval of the engineer and owner shall be removed and replaced with acceptable material without cost to the owner. Contractor is responsible for providing any additional work or adjustments caused by substituted equipment needed for compliance or proper operation at no cost to the owner. Approval of submittals does not relieve the contractor of this responsibility.
18. The PV system contractor shall coordinate with the general contractor and the electrical contractor to insure that the complete PV system is installed as described in these drawings.
19. Fall Arrest Protection per OSHA requirements shall be provided for all roof work.
20. PV contractor shall provide and install all equipment shown on these drawings except work labeled "E.C." or "By Others". Electrical contractor shall provide and install all work labeled "E.C." or "By Others".
21. Inverter shall have factory installed UL approved PV disconnect. Some jurisdictions may require an additional PV disconnect outside of the inverter. Contractor shall verify requirements.
22. All conductors and terminations shall be rated for 75°C minimum.

Required Labels and Signs

1. A permanent warning label shall be applied to the distribution equipment with the following or equivalent marking: "WARNING-INVERTER OUTPUT CONNECTIONS DO NOT EXCEED THIS OVERCURRENT DEVICE (CEC 690.64(B)(7))."
2. Per local fire district regulations, all PV system conduits shall be permanently labeled with fade resistant material as follows: "Caution: Solar PV Wiring May Remain Energized After Disconnection During Daylight Hours". Install labels every 20' and one at eye level for vertical conduit.
3. CEC ART. 690.14. Each DC disconnect shall be labeled with: "SOLAR PHOTOVOLTAIC POWER SYSTEM EMERGENCY DISCONNECT". Label shall be 1"x4" minimum with UV resistant black letters on yellow background.
4. CEC ART. 690.14. Each AC disconnect shall be labeled with: "SOLAR PHOTOVOLTAIC POWER SYSTEM AC DISCONNECT". Label shall be 1"x4" minimum with UV resistant black letters on yellow background.
5. CEC ART. 690.17. Each AC disconnect shall also be labeled with: "WARNING!-ELECTRIC SHOCK HAZARD-DO NOT TOUCH TERMINALS. TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION". Label shall be 1"x4" minimum with UV resistant black letters on yellow background.
6. CEC ART. 690.56(b). A placard shall be provided on the exterior and interior of the utility main service Disconnect location with the following text: "Caution: Solar Photovoltaic (PV) System Installed. When Power Disconnected, Solar PV Modules and Wiring in Conduit to Inverter May Remain Energized During Daylight Hours. Photovoltaic System Disconnects are Located at the Inverter."
7. CEC ART. 690.53. A placard, minimum 3" x 3", UV resistant, and including black letters and yellow background, shall be provided beside the DC disconnect location with the following text and correct values filled in where underscores are shown: "DC Photovoltaic Power Source: Operating Current = ____ amps Operating Voltage = ____ VDC Maximum System Voltage = ____ VDC Short Circuit Current = ____ amps."

S-5!®
The Right Way!

S-5-PV Kit

Break an arm off and add a flange nut for edge condition.

The S-5-PV Kits are furnished with the hardware shown at right, excluding the attachment clamp, which is supplied separately. S-5-PV Kits are compatible with most common metal roofing materials. Providing flexibility, S-5! offers one kit to accommodate all PV frame thicknesses from 1.3" (33 mm) to 2.5" (64 mm).

The embossed mounting disk makes the module placement guide easier to use. Four strategically placed under-disk hooks assist in wire management. The PV grab ears that hold the solar panel in place are broader to allow for ease of installation and precise module engagement. The mounting disk is universally directional and absolutely no rails are required.

A flat aluminum mounting disk with the new grab and stud is available for our VersaBracket™ PV Kit. S-5! also offers a flat stainless steel mounting disk for our stainless steel PV Kit for use on brass clamps and copper roofs.

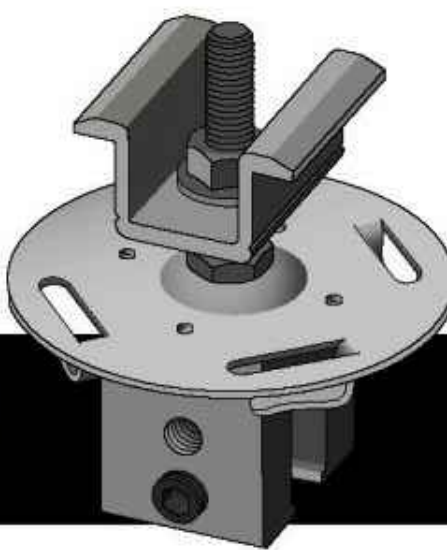
Wind dynamics are complex, thus, each system should be reviewed by a qualified licensed professional who understands wind effects on metal roof design and construction prior to purchase and installation. For more detailed information including specifications, installation instructions and CAD drawings visit www.S-5.com or your S-5-PV kit distributor.

Patents pending. Clamp sold separately.

The S-5-PV kit is a revolutionary new solution to attach solar PV panels to standing seam metal roofs!

S-5! Warning! Please use this product responsibly!
Products are provided for multiple use and involve serious risk. Visit the website at www.S-5.com for complete information on safety and warnings. For maximum building structural integrity, all components should be installed in the same manner as shown. Always use proper safety procedures and follow all applicable codes and standards. S-5! and S-5! logo are registered trademarks of S-5! Inc. © 2010 S-5! Inc. All rights reserved. S-5! and S-5! logo are registered trademarks of S-5! Inc. © 2010 S-5! Inc. All rights reserved. S-5! and S-5! logo are registered trademarks of S-5! Inc. © 2010 S-5! Inc. All rights reserved.

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Due to varied applications, clamps are not furnished with PV Kit.

REVISIONS: BY:

05/21/13	MEG
08/08/13	MEG

MONTEREY ENERGY GROUP
Consulting Mechanical Engineering
227 Forest Avenue, Suite 5, Pacific Grove, CA 93950
831.972.8328 VOICE
831.972.4613 FAX
www.montereyenergygroup.com
info@meg.com



TOMLIN
RESIDENCE
18 LA BANCHERA
CARMEL VALLEY, CA 95024

**SOLAR PHOTOVOLTAIC
RACKING SYSTEM
LAYOUT**

DATE:	07/21/15
SCALE:	AS NOTED
DRAWN:	MEG
CHECKED:	
CHECKED:	
FILE NAME:	

SHEET:

PV2.2

SHEET OF SHEETS